TITLE OF THE INVENTION

Apparatus for Delivering Carbonated Liquid at a Temperature Near or Below the Freezing Point of Water

CROSS REFERENCE TO RELATED APPLICATIONS

Provisional Patent Application No. 60/428,333 filed 11/22/02.

I. Background of the Invention

1. Field of Invention

A double tank system and refrigerated compressor device for mixing water and carbon dioxide to produce a carbonated liquid within an inner tank, cooled by compressor coils attached to the inner tank, placed within the outer tank, with a vacuum or a highly insulated foam placed in a void between the inner tank and the outer tank, delivering the chilled carbonated water product to a faucet bank for mixing with a cooled beverage syrup, providing the carbonated beverage at a temperature at or below the freezing point of water, due to the enhanced cooling ability of the system and device.

2. Description of Prior Art

The following United States patents were discovered and are disclosed within this application for utility patent. All relate to a type of beverage dispenser having a compressor which delivers a produce at a reduced temperature or in a frozen state.

In U.S. Patent no. 6,276,150 to Nelson, a beverage is mixed with carbon dioxide and then through a chiller, then further delivered to the primary target of the invention, which is the faucet or dispenser, allowing ice into the cup, followed by the cooled beverage through the same faucet means. It contains no double tank system nor claim of delivering a liquid at or below 32 degrees F.

A frozen beverage, which has entered a state of crushed ice is the delivery subject of the dispenser in U.S. Patent No. 6,301,918 to Quartarone, which also utilizes an auger to lift the frozen product into an expulsion tube to deliver the frozen product to an outlet.

A single tank carbonator is disclosed in the beverage dispenser of U.S. Patent no. 5,140,832 to Deininger, which is the common state of the prior art. U.S. Patents No. 4,866,949 and 4,970,871 to Ridick demonstrate refrigerators with single tank carbonators incorporated within the refrigerator.

The present apparatus discloses an inner tank within an outer tank, with the refrigerant coils positioned on the outer surface of the inner tank, the inner tank and outer tank also being sealed within each other with a vacuum between the two tanks or some other insulation material, a pre-chiller or heat exchanger, and also incorporates syrup tubes within the inner tank for the pre-cooling of the syrup before being mixed with the carbonated liquid at the delivery faucet.

II. Summary of the Invention

The current state of the beverage dispenser industry provides several mechanisms to provide a carbonated beverage to a customer by mixing water, carbon dioxide gas and a flavored syrup in a cooled environment with the mixed beverage delivered to one or more faucets on a counter top drink dispenser. The temperature of the dispensed beverage varies to a great extent, but no current machine is able to deliver the beverage to the faucet at or below freezing, the temperature of the beverage at the faucet being somewhere around 40 degrees. In addition, only so much liquid may be chilled by the current machines before the liquid being dispensed starts being delivered at even higher temperatures, exceeding the cooling capacity of the machines. Also significant in effecting these current machines in the environmental temperature surrounding the machines, outdoor dispensers being a greater challenge to regulate than indoor dispensers.

The present apparatus delivers the mixed soft drink beverage to the faucet at or below the freezing temperature of water which provides several benefits over the prior art. First, an advantage is gained by the beverage being less likely to melt the ice in a beverage glass upon dispensing the beverage, slowing the process of the ice turning to water which would dilute the beverage once dispensed. A second advantage is gained by the apparatus allowing for a greater volume of beverage being able to be dispensed at a lower temperature than the prior art devices because the inner tank of the double tank carbonator is not exposed to the environment surrounding the prior art carbonators, being insulated from the environment by either the vacuum in the void between the inner tank and outer tank or a highly insulating foam product. A third advantage lies in the cooling coils being contained within the same void as the inner tank, making the cooling coils transfer their cooling properties more efficiently to the inner tank and its contents than if the cooling coils were exposed to the environment of the prior art devices. This allows the refrigerant circulating system to run less often than the prior are systems, saving costs for energy required to operate the refrigerant circulating systems, which is the bulk of the cost of operation of these type of beverage dispensing units.

Noted in the apparatus is a distinction between diet syrup lines and sugared syrup lines. This is due to the effect of temperature on these ingredients. Sugared syrups may be chilled below the freezing point of water without effect on the diet syrup, to some extent, provided that the sugared syrup is not frozen. However, with diet syrup, especially when flavored with the current artificial sweetener ingredients, these sweeteners are broken down when chilled too close to the freezing point of water, and can alter the flavorings to the point of making these artificial sweeteners become bitter. Therefore, the diet syrup lines are channeled through a heat exchange unit, cooled by fresh water,

prior to delivery to the faucet bank, while the sugared syrup lines are optionally channeled through syrup coils traversing the inner tanks, lowering the sugared syrup to a temperature similar to the carbonated water.

The primary objective of the apparatus is to provide a beverage dispensing apparatus which delivers a carbonated beverage to its faucets at or below the freezing point of water by providing the apparatus with an inner tank within an outer tank with cooling coils between the two tanks in an environment not affected by outside factors including heat, air pressure or adverse weather conditions.

A secondary objective of the apparatus is to provide a more economically efficient method and space convenient component arrangement for pre-cooling the components being mixed into a carbonated beverage prior to their being combined and delivered to the faucet to enhance the efficiency of the beverage dispenser for lower the cost of operation. A third objective would be to provide the apparatus in a counter top embodiment for restaurant and concession use which is less effected by the surrounding environment of the location of the apparatus..

III. Description of the Drawings

The following drawings are submitted with this utility patent application.

Figure 1 is a flow diagram of the apparatus for delivering carbonated liquid at a temperature near or below the freezing point of water showing the integrated system.

Figure 2 is a flow diagram of the water circulation system..

Figure 3 is a flow diagram of the refrigerant system.

Figure 4 is a cutaway side view of the inner and outer tank, the hub and the temperature probe and sleeve.

Figure 5 is a side view of the inner tank within a cutaway side view of the outer tank.

Figure 6 is a front view of the heat exchange unit.

Figure 7a is a side view of a syrup tube.

Figure 7b is a side cross section of the syrup tube.

Figure 8 is a top view of the heat exchange unit.

Figure 9 is a cross section of the outer syrup coil tube.

Figure 10 is a perspective view of the hub.

Figure 11 is a top view of the outer tank indicating the placement of the plurality of syrup coils.

Figure 12 is a side view of the outer tank indicating the placement of the plurality of syrup tubes within the inner tank.

Figure 13 is an exploded view of the fluid level probe, the hub and sleeve assembly.

IV. Description of the Preferred Embodiment

An apparatus for delivering a carbonated beverage at or near the freezing point of water, connected to a fresh water line, a carbon dioxide gas tank and a beverage syrup container which blends the fresh water, carbon dioxide gas and beverage syrup together for dispensing a cold soft drink is shown in FIGS. 1-13 of the drawings and comprises essentially a double tank carbonator **10**, FIGS. 1-5, having an inner tank **20** and an outer tank **30**, with an insulated void **14** between said inner tank **20** and outer tank **30**, the inner tank **20** surrounded by a set of refrigerated cooling coils **50** integrated with a refrigerant circulating system **100**, FIG. 3, a carbon dioxide cylinder **300** with compressed gas lines **302** directing carbon dioxide gas to the inner tank **20** and to a plurality of syrup pumps **185**, a plurality of syrup lines **186**, **188** connected to a plurality of syrup tanks **180**, **182**,

including diet drink syrup tanks **180** and sugared syrup tanks **182**, each syrup line **186**, **188** connected to a separate syrup pump **185**, a first fresh water line **202** providing fresh water to a heat exchange unit **70**, FIGS. 6 and 8, and a second fresh water line **203** from the heat exchange unit **70** to a water circulating loop **210** in a water circulating system **200**, FIG. 2, a fluid level probe **65** within the inner tank **20** regulating fresh water being delivered to the inner tank **20**, and a temperature sensing means **60** within the inner tank **20** regulating the refrigerant circulating system **100.** The fresh water and carbon dioxide are combined within the water circulating loop **210** to form soda water which is then directed through a pump **214** to the inner tank **20** to a soda water inlet line **205** where the soda water is chilled to a temperature at or below the freezing temperature of water, after which the soda water is delivered to the faucet bank **350**, cycled through the heat exchange unit **350** and then returned to the water circulating loop **210**, the diet syrup lines **186** running through the heat exchange unit **70** directly to the faucet bank **350** and the sugared syrup lines **188** connected to one of a plurality of syrup coils **80**, FIGS. 7A, 7B, 9, 11 and 12, passing within the inner tank **20** of the double tank carbonator **10**, further directed to the faucet bank **350**, the faucet bank **350** blending the soda water with diet syrup for diet beverages, blending the soda water with sugared syrup for sugared beverages, a fourth fresh water line **209** dispensing fresh water at the faucet bank **350**, for consumption or further mixing with tea or other non-carbonated beverages.

As further defined, the water circulating system **200**, shown in FIG. 2, further comprises the first fresh water line **202** connected to the heat exchange unit **70,** then to a second fresh water line **203** to the water circulating loop **210**, the water circulating loop **210** having a check valve **212,** a solenoid **213** and a water circulating pump **214**, shown in FIG. 2 of the drawings. A third fresh water line **204** delivers fresh water to the water circulating loop **210**, through the pump **214** to a soda water

inlet line **205**, then to a water inlet tube **220** within the inner tank **20** of the double tank carbonator **10** where fresh water and return soda water are further mixed with carbon dioxide to form the soda water chilled to a temperature at or below the freezing temperature of water and then directed through a soda water outlet line **206** to the faucet bank **350.** From the faucet bank **350,** a first return soda line **207** delivers the chilled soda water to a central soda water tube **78** in the heat exchange unit **70** to a second return soda line **208** which connects to the third fresh water line **204**, the soda water prevented from entry into the third fresh water line **204** by the check valve **212.** This water circulating system keeps the fresh water and soda water under pressure from the carbon dioxide gas circulating within the system so the liquids do not freeze within the system, such liquids being near or below their normal freezing points.

As the carbonated liquid in mixed within the inner tank **20** and the temperature reaches the freezing point of water, an ice bank will be formed within the inner tank **20.** The temperature sensing means **60**, again indicated in FIG. 2 of the drawings, should be housed within a sealed channel **62** penetrating through the outer tank **30** and the inner tank **20** terminating near where the ice bank would be formed. The temperature sensing means **60** is integrated with the refrigerant circulating system **100**, deactivating the refrigerant circulating system **100** by sensing the temperature of the carbonated water within the inner tank as it reaches a determined set point.

The refrigerant circulating system **100** is further defined in FIG. 3, as having the set of refrigerated cooling coils **50** attached to the inner tank **20** within the void **14** between the inner tank **20** and the outer tank **30**, the void being filled with either a vacuum or a highly insulating expansion foam completely filling the void **30.** The refrigerated cooling coils **50** are connected to a first refrigerant line **102**, passing over an accumulator **110**, through a dryer **120** to a compressor **130**, to

a second refrigerant line **104** directed to a condenser unit **140**, to a third refrigerant line **106** traveling back over the accumulator **110** to the refrigerated cooling coils **50.** The refrigerant circulating system **100** is filled with a compressed refrigerated gas which under compression, is delivered at a temperature below the freezing point of water. The refrigerant circulating system **100** is regulated by the temperature sensing means **60.**

The double tank carbonator **10** is further defined in FIGS. 4 and 5, including the outer tank **30** containing the inner tank **20**, a lower end **24** of the inner tank **20** suspended within a lower end **34** of the outer tank **30** by a support peg **12.** The void **14** is located between the inner tank **20** and the outer tank **30**, and as previously indicated, the void **14** is either drawn to a vacuum or is filled with the highly insulating expansion foam, with a seal cap **16**, indicated in FIG. 5 of the drawings, giving access to the void **14** during the time of manufacture of the double tank carbonator **10.** A hub **40**, shown in FIGS. 4-5, 10 and 13, is attached to an upper end **32** of the outer tank, penetrating into an upper end **22** of the inner tank **20**, the hub **40** having a central opening **44** attaching to a perforated inner cylinder **46** within which is inserted the fluid level probe **65**, attached to the hub **40** by an attaching means **48**, the fluid level probe **65** regulating the flow of fresh water into the inner tank **20.** This fluid level probe **65** may be mechanical float mechanism or as an electronic bridge type probe, depicted in FIG. 13. The fluid level probe **65** is connected to the solenoid **213**, which regulates the flow of fresh water into the water circulating loop **210**, the fluid level probe **65** signaling the solenoid **213** to open to allow fresh water into the water circulating loop **210** when water in the inner tank **20** is low, and signaling the solenoid **213** to close to disallow fresh water into the water circulating loop **210** when the inner tank **20** is full.

The hub **40** has a plurality of holes **42**, a first hole **42a** accepting the compressed gas line **302**

from the carbon dioxide cylinder **300** introducing carbon dioxide gas into the inner tank **20**, a second hole **42b** accepting the soda water inlet line **205** connected to the water inlet tube **220** forming a J-tube **222** within the inner tank **20**, a third hole **42c** accepting the soda water outlet line **206**, and a fourth hole **42d** provided for pressure relief. The J-tube **222**, the compressed gas line **302** and the soda water outlet line **206** are directed to the lower end **24** of the inner tank **20.** In the alternative, any of the lines running through the hub **40** may be introduced by direct line to the inner tank without passing through the hub, by penetration of the outer tank and inner tank.

The heat exchange unit **70**, shown in FIGS. 6 and 8, further comprises a sealed cylindrical frame member **72** having an inner cavity **73** with a fresh water inlet **74** and a fresh water outlet **75**, the fresh water inlet **74** connected to the first fresh water line **202** and the fresh water outlet **75** connected to the water circulating loop **210** through the second fresh water line **203.** Within the heat exchange unit **70** are a plurality of diet syrup tubes **76** through which the diet syrup passes, the diet syrup tubes **76** connecting to the diet syrup lines **186**, cooling the diet syrup within the diet syrup lines **186** prior to terminating at the faucet bank **350.** The heat exchange unit **70** may be attached to the outer tank **30** of the double tank carbonator **10** by a bracket **77**, shown in FIG. 8 of the drawings. A central soda line **78** also runs within the inner cavity **73**, connected between the first return soda line **207** and the second soda return line **208** providing the heat exchange unit with the capacity to lower the temperature of the fresh water flowing through the inner cavity **73** and the diet syrup within the diet syrup tubes **76.**

Each of the syrup coils **80**, shown in FIGS. 7A, 7B and 9 of the drawings, is a closed tube having a syrup inlet **81** connected to a sugared syrup line **188** introducing the sugared syrup into the syrup coil **80** which further has an outer syrup tube **82** with an interior surface **83** aligned with a

multiplicity of inwardly protruding dimples **84** to create a turbulence within the syrup coil **80.** A syrup outlet **86**, connected to an internal outlet tube **87** is located within the outer syrup tube **82** to extract the sugared syrup from within the outer syrup tube **82.** This syrup outlet **86** is connected to the faucet bank **350.** Each syrup coil **80** may be secured within the double tank carbonator **10** as indicated in FIGS. 11-12 of the drawings.

Most preferably the double tank carbonator **10** is made entirely of stainless steel, which is demonstrated to have the desired thermal qualities sought in the apparatus. The cooling coils **50** are preferably copper which is attached by soldering the formed copper to the inner tank **20.** The hub **40** is best presented as a stainless steel hub with the plurality of holes **42** machined through the hub **40** leading into the inner tank **20.** The heat exchange unit **70** would preferably be made of stainless steel or another metal which would not be subject to corrosion and would have the thermal qualities required to operated the apparatus efficiently. The syrup coils **80** would also be made of similar metal materials with the interior surface **83** of the syrup coils **80** having a smooth surface or inner lining that would be resistant to a buildup of syrup over time.

The water lines and syrup lines within the apparatus would be best suited if made from stainless steel or copper with like metal couplings, although the current art uses flexible plastic hoses to connect most syrup containers and carbon dioxide cylinders to soft drink dispensers. Flexible plastic hoses would be sufficient for the lines connecting the external carbon dioxide cylinder and the external syrup containers to the apparatus, but likely not sufficient to be use for connecting the inner components of the apparatus.

It is also preferred that the inner tank **20** and outer tank **30** be a cylindrical shape with the upper end **22** and lower end **24** of the inner tank **20** and the upper end **32** and the lower end **34** of the

outer tank **30** being domed, which is preferred in the art for stability of the tanks under the pressure of a vacuum or under the pressure of a highly insulating expansion foam filling the void **14** between the inner tank **20** and outer tank **30.**

In addition to its implementation into the apparatus, the double tank carbonator **10** may by itself be incorporated into current art soft drink dispensing devices and is therefore independently made part of the specification. This independent embodiment of the double tank carbonator **10** comprises the inner tank **20** suspended with the outer tank **30**, the void **14** between the inner tank and outer tank again being occupied by a vacuum or highly insulating expansion foam, with the double tank carbonator **10** having the hub **40** accepting the third fresh water line **204** and the compressed gas line **302** from the carbon dioxide cylinder **300**, and having a soda water outlet line **206** connecting to a faucet bank **350.** Syrup coils **80** may be integrated within the double tank carbonator **10** with a syrup inlet **81** connecting to the syrup lines **186**, **188** and a syrup outlet **86** connecting the syrup coil **80** to the faucet bank **350.** The cooling coils **50** located with the void **14** may be connected to an outside refrigerant circulating system **100** with the temperature sensing means **60**, housed within a sealed channel **62** penetrating through the outer tank **30** and inner tank **20**, controlling the refrigerant circulating system **100.** The fluid level probe **65**, contained within the perforated inner cylinder **46**, inserted through the central opening **44** of the hub **40**, may be integrated with any fresh water line to control the flow of fresh water into the inner tank **20.**

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that changes in form and detail may be made therein without departing from the spirit and scope of the invention.

What is claimed is: